

REMARKS

The Examiner has rejected Claims 1-20 under 35 U.S.C. 103, over Joshi '910 in view of Joshi '866. Applicants have cancelled Claims 1-20, and now present new Claims 21-28, which are believed to define patentably over the references for the reasons given below.

As explained on pages 1-2 of the present specification, nozzles can be characterized as either "internal mix" or "external mix". An internal mix nozzle is one in which the mixing of fuel and air occurs within the interior of the nozzle, or within some enclosure forming part of the nozzle. An external mix nozzle is one in which the mixing occurs outside of the nozzle. As stated in the specification, the nozzle of the present invention is of the external mix type.

Of the two Joshi patents, applied by the Examiner to Claims 1-20, the '910 patent shows an external mix nozzle, but the '866 patent shows an internal mix nozzle. In particular, Joshi '866 teaches a precombustor 14, which comprises an enclosure located downstream of the nozzle or burner 12, and which is firmly bolted to the nozzle 12. Thus, Applicants submit that, apart from the other reasons for patentability presented below, the two Joshi patents cannot be logically combined, because they show nozzles of opposite types.

The nozzle of the present invention includes two structural features which are important to the operation of the nozzle. The first is the taper of the outer conduit, which focuses the gas in the outer conduit such that the high velocity gas molecularly entrains the fuel exiting the inner conduit, at a position downstream of the outlet end of the nozzle.

The Examiner has cited the taper in the outer conduit of Joshi '910. However, that conduit of Joshi '910 is only partially tapered. In particular, as shown in Figure 2 of Joshi '910, it is the outer surface of the inner piece 56 which is tapered, but the inner surface of the outer piece 54 is not tapered. Thus, the nozzle of Joshi '910 would not effectively focus the gas onto the desired location downstream of the nozzle.

In the nozzle of the present invention, by contrast, the inner surface of the outer piece 23 and the outer surface of the inner piece 21 are both tapered, and are generally parallel to each other in the vicinity of the outlet end. This feature is especially apparent from Figures 1 and 4 of the present application. Thus, the nozzle of the present invention effectively focuses the fluid in the outer conduit (normally air or oxygen) towards an optimal location, exterior to the nozzle, for promoting the mixing of fuel and air.

Applicants note that Joshi '866 also does not teach the claimed taper. In Joshi '866, the divergent outer gas conduit serves to reduce gas velocity, which is exactly the opposite of what the present invention achieves.

The Examiner has cited Joshi '866 for its teaching of a rounded edge. However, the rounded edge in Joshi '866 is formed on the outer edge 36 of the inner pipe. The rounded edge of the present invention is formed on the inner edge of the inner piece.

The above-described difference has important consequences. The rounded edge of the present invention, has the purpose and effect of inducing fluid (normally fuel) to follow the curvature of the edge, and thus to promote immediate mixing of fuel with air. In Joshi '866, by

contrast, the purpose and effect of the rounding of the outer edge 36 is to delay mixing of fuel and air, so that the mixing might occur later.

Thus, Joshi '866 teaches away from the nozzle of the present invention, both because the reference teaches an internal mix nozzle, not an external mix nozzle, and because it teaches rounding of the outer edge of the inner pipe, instead of rounding of the inner edge.

Applicants have written the new claims to emphasize the features discussed above. First, all of the new claims now recite that the nozzle is free of any enclosure downstream of the outlet end, so that fluids exiting the conduits at the outlet end mix in a region exterior to the nozzle. In other words, all of the claims recite an exterior mix nozzle.

Because all of the pending claims are limited to an exterior mix nozzle, Applicants submit that it is not proper to combine Joshi '910 and Joshi '866 under Section 103, because one reference teaches an external mix nozzle and the other teaches an internal mix nozzle.

New Claim 21 also recites the rounding of the inner edge of the inner conduit. Thus, Claim 21 defines patentably over Joshi '866, which teaches the opposite of what is now recited in Claim 21. Even if the Joshi patents were combined, they would not yield what is recited in Claim 21. Therefore, Claim 21 is believed allowable.

Claim 22 adds the feature wherein the surfaces defining the outer conduit are generally parallel near the outlet end. This feature is not shown in Joshi '910, and is believed to be a further distinguishing limitation.

Claim 23 recites a burner made with the nozzle of Claim 22, and is believed allowable for the same reasons.

Claim 24 recites an external mix nozzle in which the surfaces defining

the outer conduit are generally parallel in the vicinity of the outlet end. This claim therefore distinguishes over Joshi '910. Thus, even if Joshi '910 were combined with Joshi '866, the result would not be what is claimed. Therefore Claim 24 is believed allowable. Claim 25 depends from Claim 24, and is also believed allowable.

Claims 26-28 contain similar limitations to those discussed above, are believed allowable for the same reasons.

Applicants have considered the other references cited by the Examiner but not applied to the claims. The patent to van Hardeveld shows an internal mix nozzle, and is therefore not pertinent. The patent to Anderson also shows an internal mix nozzle. Thus, neither reference is believed to affect the patentability of the pending claims.

Applicants therefore submit that new Claims 21-28 define patentably over the references.